

1 REMARKS

2 Status of the Claims

3 Claims 24-33 and 38-42 are pending in the present application, new Claims 41 and 42 having
4 been added in the present amendment. Claims 30-33 have been amended to correct an antecedent
5 basis issue and Claim 39 has been amended to more clearly define the present invention.

6 Objection to the Specification

7 The Examiner has objected to the specification because the "Related Applications" section refers
8 to a parent application by serial number alone, and the Examiner correctly notes that the parent
9 application has issued as a patent. Applicants have amended the "Related Applications" section to
10 specifically note that U.S. Patent Application Serial No. 10/355,653, filed on January 29, 2003, has issued
11 as U.S. Patent No. 6,707,551. Accordingly, this objection to the specification should be withdrawn.

12 Objection to the Abstract

13 The Examiner has objected to the Abstract of the Disclosure because it exceeds 150 words.
14 Applicants respectfully note that at the time the parent application of this Divisional application was
15 filed, the Abstract of the Disclosure was limited to 250 words and met that requirement. In
16 recognition of the current requirement that the Abstract of the Disclosure be limited to no more than
17 150 words, applicants have amended the Abstract of the Disclosure to be less than 150 words in
18 length. Accordingly, this objection should be withdrawn.

19 Objection to FIGURE 11

20 The Examiner has objected to FIGURE 11, noting that the triangular data points and square
21 data points do not match the textual description in the specification. According to the specification as
22 filed, line 141 includes triangular data points and line 143 includes square data points. The Examiner
23 has correctly noted that in FIGURE 11 line 141 includes square data points and line 143 includes
24 triangular data points. Applicants have amended the corresponding text in the specification to
25 conform to FIGURE 11. Accordingly, this objection to the FIGURE 11 should be withdrawn.

26 Objection to the Drawings under 37 C.F.R. 1.83a

27 The Examiner has objected to the drawings because they do not show every feature of the
28 invention specified in the claims. The Examiner asserts that the recited means for controlling a waist of
29 a beam of light has not been shown in the drawings, and therefore such means must either be included
30 in the drawings are canceled from Claims 39-40. For the reasons discussed below, applicants agree that

1 the Examiner is technically correct that means are not disclosed for controlling a waist of the beam.
2 However, means are disclosed for controlling a diameter of the beam of light within the reflection
3 cavity.

4 As noted in the specification, a beam waist is a general characteristic of a portion of an optical
5 beam, and represents the point of smallest cross-sectional area of the beam. The beam cross-sectional
6 size increases in either direction away from the waist at a rate that is inversely proportional to the size
7 of the waist (see applicants' specification, page 13, first paragraph). In a preferred embodiment of
8 the invention, the optical beam is introduced into the illumination system such that the beam waist is
9 preferably disposed at a midpoint of the beam traversal through the reflection cavity (page 13, first
10 paragraph). In particular, FIGURE 11 graphically depicts two beams each having a different beam
11 waist disposed at a midpoint of the beam traversal through the reflection cavity, showing the increase
12 in beam size that occurs in each direction relevant to the midpoint (i.e., cavity pass number three).

13 The specification also clearly describes that it would be desirable to maintain a high beam
14 intensity throughout the reflection cavity, which would require maintaining a relatively small cross-
15 sectional beam size. The specification clearly teaches that the naturally occurring beam size dispersion
16 indicated in FIGURE 11 can be counteracted by incorporating optical powers into the reflecting surfaces
17 of the cavity (see page 14, line 19 through page 15, line 14). FIGURES 14A and 14B clearly illustrate a
18 reflection cavity incorporating optical powers in the reflection surfaces, i.e., wherein the reflection
19 surfaces are concave to refocus the reflected beam each time the beam it moves away from the beam
20 waist or position of the beam's cross-sectional minimum. This refocusing counteracts the dispersion that
21 would otherwise increase the beam size and decrease the luminous intensity.

22 The claim element to which the Examiner has objected is "means for controlling a waist of
23 the beam of light." Applicants' specification clearly indicates that a beam waist represents that
24 portion of the beam exhibiting a minimum cross-sectional size. The optical powers (concave shape
25 of the reflecting surfaces) described in connection with FIGURES 14A and 14B are disclosed as
26 minimizing beam dispersion, which would tend to increase the beam size as the distance from the
27 beam waist increases. Rather than actually controlling the beam waist, this technique actually
28 controls beam size away from the beam waist. Accordingly, the Examiner is correct, and Applicants
29 have therefore amended the claim language to recite means for controlling a diameter of the beam in
30 the reflection cavity, as opposed to controlling the beam waist.

1 It should be noted that the specification as filed describes additional techniques to control a diameter
2 of the beam in the reflection cavity, above and beyond the use of curved reflective surfaces. For example,
3 the separation distance between the reflective surfaces can be made narrower to decrease the path length that
4 the beam travels at it traverses the reflection cavity. In this manner, the number of passes in the cavity can
5 be increased while still maintaining a small cross-sectional beam size and thereby maintaining relatively
6 high beam intensity (page 13, lines 26-32). Another technique that can be used to control the diameter of
7 the beam in the reflection cavity is to: (1) configure the illumination system so that the beam waist is
8 disposed at a midpoint in the reflection cavity; and then, (2) select a source to achieve a beam waist in the
9 reflection cavity that exhibits a specific size (page 13, first paragraph). FIGURE 11 clearly illustrates the
10 increase of beam diameter in each direction away from the beam waist. If a first light source achieving a
11 beam waist of 50 μ at a midpoint in a reflection cavity is used, and a second light source achieving a beam
12 waist of 80 μ at a midpoint in the reflection cavity is used, the relative diameters of the first and second light
13 beams at different portions of the reflection cavity will be different, as clearly indicated in FIGURE 11.
14 Thus, selecting a specific beam waist size will have an effect on the relative diameter of the beam in
15 different parts of the reflection cavity. Furthermore, the beam waist itself can be positioned to be at other
16 than a midpoint of the reflection cavity, which would mean that the relative beam diameter within reflection
17 cavity will vary according to the functions illustrated in FIGURE 11, but the position of the beam waist
18 relative to the reflection cavity will be shifted. If the beam waist is disposed outside the reflection cavity,
19 then the beam size will only diverge as the beam traverses the cavity, whereas if the beam waist is disposed
20 inside the reflection cavity, the beam size will converge to a minimum (i.e., to the beam waist size inside the
21 reflection cavity). These relationships are clearly disclosed in applicants' specification and drawings (see
22 FIGURE 11 and page 13, first paragraph).

23 Accordingly, the specification and drawings describe and illustrate three different means for
24 controlling a diameter of a light beam in the reflection cavity. Support for the amendment to Claim 39 (i.e.,
25 a description is provided of three means for controlling a diameter of a light beam in the reflection cavity)
26 are included in applicants' specification and drawings, and the Examiner's rejection of the drawings under
27 37 C.F.R. 1.83a should be withdrawn.

28 Claims Rejected under 35 U.S.C. § 112, First Paragraph

29 The Examiner has rejected Claims 39 and 40 under 35 U.S.C. § 112, first paragraph, as failing to
30 comply with the enablement requirement. The Examiner asserts that the claims contain subject matter

1 which was not described in the specification in such a way as to enable one skilled in the art to which it
2 pertains, or with which it is most nearly connected, to make and/or use the invention. Specifically, the
3 Examiner asserts that the limitation “means for controlling a waist of the beam of light” is not described
4 in the specification in such a way as to enable one skilled in the art to which it pertains.

5 As discussed above, applicants recognize that the recited “means for” clause is more properly
6 recited as means for controlling a diameter of the light beam in the reflection cavity. As discussed in detail
7 above in regard to the objection to the drawings under 37 C.F.R. 1.83a, the specification and drawings as
8 filed do describe at least three ways to control a diameter of the beam of light in the reflection cavity.

9 As amended, the recitation of Claims 39 and 40 (specifically, recitation of means for
10 controlling a diameter of a light beam in the reflection cavity) are enabled by the specification and
11 drawings. Accordingly, the Examiner's rejection of Claims 39 and 40 under 35 U.S.C. § 112, first
12 paragraph, should be withdrawn.

13 The Rejection of Claims 24, 27, 29, 30 and 39 under 35 U.S.C. § 103

14 The Examiner has rejected Claims 24, 27, 29, 30, and 39 under 35 U.S.C. § 103(a) as being
15 unpatentable over Levine (U.S. Patent No. 5,854,685) in view of Ambrose (U.S. Patent No. 6,309,886).
16 The Examiner asserts that Levine discloses an equivalent reflection cavity, and Ambrose discloses optics
17 disposed to collect light from an object passing through a cavity, as well as a light detector disposed to use
18 light from the optics to detect at least one characteristic of the object. The Examiner asserts that would have
19 been obvious to incorporate Ambrose's optics and detectors into Levine's reflection cavity to provide a more
20 accurate apparatus for determining one or more characteristics of an object suspended a flow stream from an
21 image of the object. Applicants respectfully disagree for the following reasons.

22 Levine is directed to a holographic analyzer for determining the concentration of substances
23 in a fluid in response to the infrared absorbance of the substances. Levine illustrates and describes a
24 holographic analyzer system that comprises a chamber, a light source, one or more holographic
25 reflective pads, and a photodetector. Figures 1 and 2b in Levine illustrate a light beam directed into
26 the chamber at an acute angle to the holographic reflective pads such that the light beam reflects back
27 and forth between the holographic reflective pads disposed opposite each other. Objects are not
28 traversing the chamber disclosed by Levine. In contrast, Levine's chamber is filled with a fluid, and
29 then the amount of light absorbed by substances in the fluid can be used to determine a concentration
30 of those substances in that fluid.

1 Significantly, Levine does not teach or suggest detecting light from an object. In fact, Levine
2 describes a system in which *only the light beam that was reflected back and forth is detected*.
3 Specifically, Levine shows and explicitly teaches a light beam that exits the reflection cavity and is
4 incident on a detector after experiencing absorption by the fluid in the reflection cavity so that the
5 absorption of light by the fluid and other components in the cavity can be measured. Thus, Levine's
6 apparatus is designed to measure how much of a beam of light passing through a reflection cavity is
7 absorbed by matter in the reflection cavity. This measurement is critical to the functionality of
8 Levine's device, and the light beam traversing the reflection cavity must ultimately be directed
9 toward a detector, so that the intensity of the light beam can be measured. *Levine clearly does not*
10 *teach or suggest a detector disposed so that light from an object within the reflection cavity is*
11 *incident upon the detector*, as recited by applicants' Claim 24. Applicants' detectors are configured
12 to receive images of objects in order to determine at least one characteristic of an object. Clearly,
13 Levine's detectors are not equivalently positioned to the detectors defined in applicants' claims.

14 Further, there is no basis for concluding that one of ordinary skill would be led modify Levine
15 to include a detector that does NOT receive light from the light beam being reflected in the reflection
16 cavity, because such a modification would render Levine *unsatisfactory for its intended purpose* (see
17 MPEP 2143.01). Without a detector positioned to measure an intensity of the beam of light being
18 reflected back and forth in the reflection cavity, no information can be collected about how much of
19 that beam of light has been absorbed by matter in the reflection cavity. Thus, the stated purpose of
20 Levine, which is determining the concentration of substances in a fluid in response to the infrared
21 absorbance of the substances, cannot be achieved if Levine is modified to produce the invention recited
22 in Claim 24, and as indicated by MPEP 2143.01, reliance on such a modification to support an assertion
23 that a claim is obvious, is not proper grounds for rejection of the claim.

24 It is also important to recognize that the cited art provides no motivation for one of ordinary skill
25 in the art to modify Ambrose's flow cytometer to replace a non-reflection cavity with Levine's reflection
26 cavity. Levine specifically teaches that the purpose of the reflection cavity is to increase the length of the
27 light path between the source and a detector that is contained within the reflection cavity, to enable
28 Levine's system to be more sensitive when detecting the absorption of light from objects contained within
29 the reflection cavity, thereby providing an indication of the concentration of those objects in the reflection
30 cavity. Ambrose's flow cytometer does not attempt to determine the concentration of objects contained in

1 the flow cavity; in contrast, Ambrose's system is configured to enable images of the objects contained in
2 the flow cavity to be obtained. Neither cited reference suggests how incorporating Levine's reflection
3 cavity into Ambrose's flow cytometer system would achieve a beneficial result. Nor is there any evidence
4 that such a combination would solve a problem recognized by one of ordinary skill in the art.

5 Modifying Levine's apparatus to include Ambrose's optics and detectors cannot be obvious,
6 because such with a modification would render Levine *unsatisfactory for its intended purpose* (see
7 MPEP 2143.01). Modifying Ambrose's apparatus to include Levine's reflection cavity might
8 theoretically be possible; however, it is well accepted that simply because one of ordinary skill in the
9 art *could have* made the required changes does not establish obviousness. Some motivation that
10 would lead one of ordinary skill to make the modification is required. MPEP 2143.01 also states
11 "The level of skill in the art cannot be relied upon to provide the suggestion to combine references."
12 Rather than the art recognizing or suggesting any obvious benefit from replacing Ambrose's cavity
13 with Levine's reflection cavity, it appears that such a combination is based on hindsight, rather than
14 the required motivation. Because dependent claims are patentable for at least the same reasons as the
15 independent claims from which they depend, Claims 27, 29, and 30 are patentable for at least the
16 same reasons as Claim 24. Accordingly, the rejection of Claims 24, 27, 29, and 30 as being obvious
17 over Levine in view of Ambrose should be withdrawn.

18 Referring now to the rejection of independent Claim 39 as being obvious over Levine in view
19 of Ambrose, the Examiner indicates that the recited means limitation was given no patentable weight
20 because it appeared to the Examiner that the limitation had not been adequately described by the
21 specification or shown in the drawings. As discussed in detail above, applicants have amended the
22 "means for" recitation included in Claim 39 to recite means for controlling a diameter of the light
23 beam in the reflection cavity. The above discussion describes three different techniques disclosed by
24 the specification and drawings that describe and support the amended "means for" clause. Neither
25 Ambrose nor Levine teaches or suggests any equivalent means. Accordingly, the rejection of
26 Claim 39 as being obvious over Levine in view of Ambrose should be withdrawn.

27 The Field of View

28 In connection with the rejection of Claim 24 (as discussed in detail above) the Examiner asserts that
29 the claim provides no indication about the orientation of the *field of view*, i.e., whether it is relative to an
30 observer or to a detector or to some other point of reference. Applicants respectfully submit that both the

1 claim language and the disclosure clearly indicate to one of ordinary skill in the art the meaning of the term
2 “*field of view*.” Claim 24 specifically recites that the *field of view* is traversed by an object, that the *field of*
3 *view* is included in the reflection cavity defined by the first reflecting surface and the second reflecting
4 surface, and that light reflected back and forth between the first reflecting surface and the second reflecting
5 surface crosses the *field of view* a plurality of times. Clearly, Claim 24 provides significant detail as to the
6 characteristics of the *field of view* that should leave no question as to the meaning of this phrase. Referring
7 to applicants’ specification, FIGURES 1 and 12 clearly illustrate the *field of view* as being a plane disposed
8 within the reflection cavity, such that objects introduced into the reflection cavity pass through the plane,
9 and light reflected back and forth through the reflection cavity from the reflective surfaces also passes
10 through the plane. Applicants respectfully submit that one of ordinary skill of the art would thus understand
11 the meaning of the term *field of view* within the context of the claimed invention.

12 The Rejection of Claims 25 and 28 under 35 U.S.C. § 103

13 The Examiner has rejected Claims 25 and 28 under 35 U.S.C. § 103(a) as being unpatentable
14 over Levine (U.S. Patent No. 5,854,685) in view of Ambrose (U.S. Patent No. 6,309,886), further in
15 view of Kain (U.S. Patent No. 5,754,291). Claims 25 and 28 are dependent claims that recite that the
16 first and second detectors comprise time delay integration detectors (TDI). The Examiner notes that
17 Kain discloses a TDI detector, and asserts that it would have been obvious to include the TDI
18 detector disclosed by Kain with the combination of Ambrose and Levine discussed above.
19 Applicants respectfully disagree for the following reasons.

20 As noted above with respect to applicants’ traverse of the rejection of independent Claim 24,
21 modifying Levine’s apparatus in view of Ambrose is impermissible, because such a combination would
22 change Levine’s basic operating principles and intended functionality. Modifying Ambrose’s apparatus to
23 include Levine’s reflection cavity is also not a valid basis for an obviousness rejection, because there is no
24 suggestion in the cited art that would lead one of ordinary skill to conclude that the reflection cavity
25 disclosed by a Levine would be useful in Ambrose’s apparatus for obtaining an image of an object (i.e.,
26 because Levine does not teach or suggest that the reflection cavity disclosed by Levine can be used to obtain
27 images from objects). Dependent claims are patentable for at least the same reasons as the independent
28 claims from which they depend. Therefore Claims 25 and 28 each are patentable for at least the same
29 reasons as Claim 24. Accordingly, the rejection of Claims 25 and 28 as being obvious over Levine in view
30 of Ambrose, further in view of the Kain, should be withdrawn.

1 The Rejection of Claim 26 under 35 U.S.C. § 103

2 The Examiner has rejected Claim 26 under 35 U.S.C. § 103(a) as being unpatentable over
3 Levine (U.S. Patent No. 5,854,685) in view of Ambrose (U.S. Patent No. 6,309,886), further in view
4 of Sweedler (U.S. Patent No. 5,141,609). Claim 26 is a dependent claim that recites that the detector
5 comprises a photomultiplier tube. The Examiner notes that Sweedler discloses a photomultiplier
6 tube, and asserts that it would have been obvious to include the photomultiplier tube disclosed by
7 Sweedler in the combination of Ambrose and Levine discussed above. Applicants respectfully
8 disagree for the following reasons.

9 As discussed in detail above, the combination of Ambrose and Levine does not achieve an
10 intervention equivalent to that recited in independent Claim 24. Dependent claims are patentable for
11 at least the same reasons as the independent claims from which they depend, therefore Claim 26 is
12 patentable for at least the same reasons as Claim 24. Accordingly, the rejection of Claim 26 as being
13 obvious over Levine in view of Ambrose, further in view of the Sweedler, should be withdrawn.

14 The Rejection of Claim 38 under 35 U.S.C. § 103

15 The Examiner has rejected Claim 38 under 35 U.S.C. § 103(a) as being unpatentable over
16 Levine (U.S. Patent No. 5,854,685) in view of Ambrose (U.S. Patent No. 6,309,886), further in view
17 of deMay (U.S. Patent No. 4,311,387). The Examiner asserts that Levine and Ambrose collectively
18 disclose each element of the claimed invention except for *said first reflecting surface and said second*
19 *reflecting surface being sized and oriented such that said beam of light both enters and exits said*
20 *reflection cavity adjacent one of said first reflecting surface and said second reflecting surface*. The
21 Examiner notes that deMay discloses the element lacking in Levine and Ambrose, and concludes that
22 it would have been obvious to one of ordinary skill in the art to modify the combination of Levine
23 and Ambrose to include the orientation of reflective surfaces disclosed by deMay. Applicants
24 respectfully disagree for the following reasons.

25 The Examiner appears to assert that deMay discloses a beam of light entering a reflection
26 cavity adjacent to one of reflecting surface 22 and reflecting surface 26 (see FIGURE 1 of deMay).
27 According to deMay reflecting surface 22 and reflecting surface 26 are elements of
28 monochromator 18. The function of monochromator 18 is to receive light including a plurality of
29 wave lengths, and to emit light having only a single wavelength. Significantly, monochromator 18 is
30 not equivalent to applicants' reflection cavity, because monochromator 18 is not configured to allow

1 objects to pass through it, such that a light beam is reflected back and forth between first and second
2 reflecting surfaces to illuminate an object within it. Furthermore, deMay does not reflect light back
3 and forth between reflecting surface 22 and reflecting surface 26. Instead, according to deMay, light
4 simply is reflected from reflecting surface 22 onto reflecting surface 26, never returning to reflecting
5 surface 22 (instead light escapes from monochromator 18 through an exits slit 28). Furthermore, with
6 respect to monochromator 18, light enters monochromator 18 via entrance slit 16 and exits
7 monochromator 18 via exits slit 28. Neither entrance slit 16 nor exit slit 28 are adjacent to either
8 reflecting surface 22 or reflecting surface 26, as required by applicants' claim language. Thus deMay
9 does not disclose a reflection cavity equivalent to that recited by applicants.

10 It does not appear that it would have been obvious to one of ordinary skill in the art to modify the
11 reflection cavity disclosed by Levine in view of deMay to achieve applicants' recited reflection cavity. It
12 is true that deMay teaches that light both enters and exits from one side of monochromator 18; and,
13 because applicants' reflection cavity is defined by opposed reflections surfaces, it is true that light can
14 enter and exit the reflection cavity defined in applicants' Claim 38 from one side of the reflection cavity.
15 However, the configuration of the reflective surfaces in applicants' reflection cavity and deMay's
16 monochromator 18 are not equivalent. Note that applicants have not claimed a reflection cavity where
17 light enters and exits from the same side (which is true of monochromator 18), but rather a reflection
18 cavity where light enters and exits *adjacent to one of the two reflection surfaces*. Significantly, light
19 neither enters nor exits deMay's monochromator 18 adjacent to any reflecting surface. In contrast, light
20 enters and exits deMay's monochromator 18 opposite both reflecting surfaces. Further, the cited art does
21 not teach or suggest a benefit for light entering and exiting monochromator 18 from the same side, so that
22 one of ordinary skill in the art might be lead to modify Levine's reflection cavity to achieve applicants'
23 reflection cavity (in which light enters an exits from the same side of the reflection cavity), particularly
24 because deMay's monochromator 18 and Levine's reflection cavity serve completely different functions.
25 Accordingly, the suggested combination does not achieve an equivalent invention, and the rejection of
26 Claim 38 as obvious over Levine in view of Ambrose, further in view of deMay, should be withdrawn.

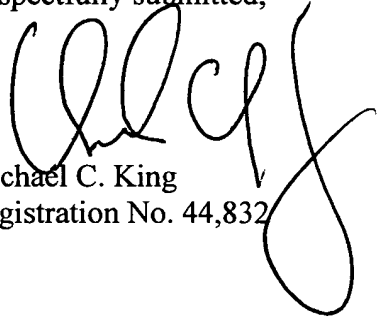
27 Claims to Which the Examiner Has Objected -- Patentable Subject Matter

28 The Examiner has objected to Claims 31-33, indicating that if such claims were rewritten in
29 independent form they would be allowable. Applicants have added new Claim 41, which includes
30 the novel and patentable subject matter from Claim 31. Accordingly, Claim 41 should therefore be

1 allowed. However, it must be noted that Claim 41 does not include all of the recitation from
2 Claims 24 and 31. New Claim 42 depends from Claim 41, and further recites the optics and detector
3 also recited in Claim 24 and is patentable for the same reasons.

4 In consideration of the preceding Remarks, it will be apparent that all claims in this
5 application recite patentable subject matter. The Examiner is therefore requested to pass this case to
6 issue without further delay. In the event that any questions remain unresolved, the Examiner is
7 invited to telephone applicants' attorney at the number listed below.

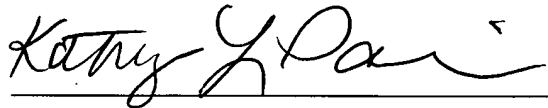
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9 Respectfully submitted,

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14 MCK/RMA:lrg

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16 I hereby certify that this correspondence is being deposited with the U.S. Postal Service in a sealed
17 envelope as first class mail with postage thereon fully prepaid addressed to: Commissioner for Patents,
18 Alexandria, VA 22313-1450, on February 16, 2005.

19 Date: February 16, 2005

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